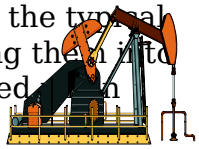
US Army Corps of Engineers

FACT SHEET

Naturally Occurring Radioactive Material and Oil/Gas Production

Terminology: Two terms necessary to understand when discussing radiation protection are the Curie and the Rem. The Curie (Ci) is a unit of radioactivity that expresses the number of atoms decaying per second. A Curie represents 37 billion atoms decaying per second. The rem is a unit of dose equivalent that expresses the relative biological effect of radiation dose. USACE radiation workers are only allowed to receive 0.5 rem (500 mrem) above background per year[1].



Since both units are very large compared to the typical levels encountered in nature we use prefixes to bring them into perspective. The following prefixes are typically used when discussing the rem and Curie.

- milli (m) = 1 thousandth
- micro (u) = 1 millionth
- pico (p) = 1 trillionth

NORM and Oil: Naturally occurring radioactive material (NORM) is associated with oil and gas production. NORM is brought to the surface primarily in the production water and sludge. Typically the longer a facility operates the more NORM is brought to the surface. The radioactive material is typically located in pipe scales and equipment or soils around produce water handling or storage areas. Soil may also become contaminated with radioactive scale from pipe and tank cleaning operations.

Although the radioactivity of the scales and sludge can reach into the thousands of picoCuries (pCi) per gram (g) the average

NORM	Scale pCi/g (Average)	Sludge pCi/g (Average)	EPA Soil Cleanup Criteria pCi/gm
Radium-226	360	56	5
Lead-210	360	56	5
Polonium-210	360	56	5
Radium-228	120	19	5
Thorium-	120	19	5